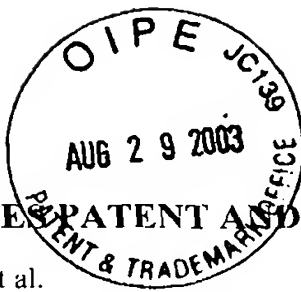


Docket No. 218290US2



IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

IN RE APPLICATION OF: Kouichi OHTAKA, et al.

SERIAL NO: 10/050,865

GAU: 2872

FILED: January 18, 2002

EXAMINER:

FOR: OPTICAL MODULATOR, OPTICAL MODULATOR MANUFACTURING METHOD, LIGHT INFORMATION PROCESSING APPARATUS INCLUDING OPTICAL MODULATOR, IMAGE FORMATION APPARATUS INCLUDING OPTICAL MODULATOR, AND IMAGE PROJECTION AND DISPLAY APPARATUS INCLUDING OPTICAL MODULATOR

INFORMATION DISCLOSURE STATEMENT UNDER 37 CFR 1.97

COMMISSIONER FOR PATENTS
ALEXANDRIA, VIRGINIA 22313

SIR:

Applicant(s) wish to disclose the following information.

REFERENCES

- ☐ The applicant(s) wish to make of record the references listed on the attached form PTO-1449. Copies of the listed references are attached, where required, as are either statements of relevancy or any readily available English translations of pertinent portions of any non-English language references.
- ☐ A check is attached in the amount required under 37 CFR §1.17(p).

RELATED CASES

- ☒ Attached is a list of applicant's pending application(s) or issued patent(s) which may be related to the present application. A copy of the claims and drawings of the pending application(s) is attached.
- ☐ A check is attached in the amount required under 37 CFR §1.17(p).

CERTIFICATION


- ☐ Each item of information contained in this information disclosure statement was first cited in a communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of this statement.
- ☒ No item of information contained in this information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application or, to the knowledge of the undersigned, having made reasonable inquiry, was known to any individual designated in 37 CFR §1.56(c) more than three months prior to the filing of this statement.

DEPOSIT ACCOUNT

- ☒ Please charge any additional fees for the papers being filed herewith and for which no check or credit card payment form is enclosed herewith, or credit any overpayment to deposit account number 15-0030. A duplicate copy of this sheet is enclosed.

Respectfully submitted,

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LIST OF RELATED CASES

<u>Docket Number</u>	<u>Serial or Patent Number</u>	<u>Filing or Issue Date</u>	<u>Inventor/ Applicant</u>
218290US2*	10/050,865	01/18/02	OHTAKA et al.
238393US2	10/449,115	06/02/03	OHTAKA et al.

*Present Application; listed for information

GJM/ae

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WHAT IS CLAIMED IS:

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1. An optical scanning device, comprising:
optical modulation means for modulating a
beam and having an one-dimensional optical modulator
array wherein a plurality of optical modulators are
10 arranged one-dimensionally;
lighting means for lighting the one-
dimensional optical modulator array; and
a scanning optical system for deflecting the
beams modulated by the optical modulators in the one-
15 dimensional optical modulator array in a direction
perpendicular to the arrangement direction of the
optical modulators,
wherein a plurality of the one-dimensional
optical modulator arrays are arranged in a direction
20 perpendicular to the arrangement direction of the
optical modulators, and
the beams modulated by respective optical
modulators of the one-dimensional optical modulator
arrays can be irradiated on a pixel in piles.

25

FOR INFORMATION
DISCLOSURE
PURPOSES ONLY

Related Pending Application
Related Case Serial No: 10/449,115
Related Case Filing Date: 06-02-03

2. The optical scanning device as claimed in claim 1, wherein the arrangement pitch of the one-dimensional optical modulator array is an integer multiples of the size of the optical modulator in the arrangement direction of the optical modulator.

10 3. The optical scanning device as claimed in claim 1, wherein the scanning optical system includes a projection optical system for projecting and forming an image with the beam scanned by the scanning optical system at an image indication object surface.

20 4. The optical scanning device as claimed in claim 1, wherein the optical modulators of the one-dimensional optical modulator array are elements that modulate the beam by changing the reflection direction of the beam with a movable mirror.

25

5. The optical scanning device as claimed in claim 4, wherein the optical modulators of the one-dimensional optical modulator array are elements that drive the movable mirror by an electrostatic force.

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6. The optical scanning device as claimed in
10 claim 1, wherein the optical modulators of the one-dimensional optical modulator array are crystal liquid optical switch elements.

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7. The optical scanning device as claimed in claim 1, wherein the lighting means includes a micro lens array having a plurality of micro lenses that
20 correspond to the respective optical modulators of the one-dimensional optical modulator array one to one.

8. The optical scanning device as claimed in claim 7, wherein the micro lens array includes a lightproof part situated between the micro lenses that neighbor each other.

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9. The optical scanning device as claimed in claim 1, wherein the optical scanning system is formed by a rotating polygon mirror.

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10. The optical scanning device as claimed in claim 1, wherein the optical scanning system is formed by a galvano mirror.

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11. The optical scanning device as claimed in claim 1, wherein the respective optical modulators of the one-dimensional optical modulator arrays

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perform an analog modulation by which the amount of light of the beam is changed from zero to maximum.

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12. The optical scanning device as claimed in claim 11, wherein

the analog modulation having "m" gradations
10 is performed by the respective optical modulators of the one-dimensional optical modulator arrays,

the number of the one-dimensional optical modulator arrays is set as "n", and

the beams modulated by the optical
15 modulators corresponding to the one-dimensional optical modulator arrays are irradiated to the respective pixels in piles.

20

13. The optical scanning device as claimed in claim 1, wherein the respective optical modulators of the one-dimensional optical modulator arrays
25 perform a digital-modulation whereby time division

driving is performed in a unit of time and an integral amount of light of the beam in the unit of time is changed in phase from zero to maximum.

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14. The optical scanning device as claimed in claim 13, wherein

10 the digital modulation having "m" gradations is performed by the respective optical modulators of the one-dimensional optical modulator arrays,

 the number of the one-dimensional optical modulator arrays is set as "n", and

15 the beams modulated by the optical modulators corresponding to the one-dimensional optical modulator arrays are irradiated to the respective pixels in piles.

20

15. The optical scanning device as claimed in claim 1, wherein

the respective optical modulators of the one-dimensional optical modulator arrays perform a combined modulation comprising an analog-modulation and a digital-modulation,

5 the amount of light of the beam is changed from zero to maximum by the analog-modulation, and
 time division driving is performed in a unit time and an integral amount of light of the beam in the unit time is changed in phase from zero to
10 maximum by the digital-modulation.

15 16. The optical scanning device as claimed in claim 15, wherein

 the analog-modulation having "m" gradations and the digital-modulation having "L" gradations are performed by the respective optical modulators of the
20 one-dimensional optical modulator arrays,

 the number of the one-dimensional optical modulator arrays is set as "n", and

 the beams modulated by the optical modulators corresponding to the one-dimensional

optical modulator arrays are irradiated to the
respective pixels in piles.

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ABSTRACT

An optical scanning device includes optical modulation means having an one-dimensional optical modulator array wherein a plurality of optical modulators are arranged one-dimensionally; lighting means; and a scanning optical system for deflecting the beams modulated by the optical modulators in the one-dimensional optical modulator array in a direction perpendicular to the arrangement direction of the optical modulators. A plurality of the one-dimensional optical modulator arrays are arranged in a direction perpendicular to the arrangement direction of the optical modulators. The beams modulated by respective optical modulators of the one-dimensional optical modulator arrays can be irradiated on a pixel in piles.

FIG.1

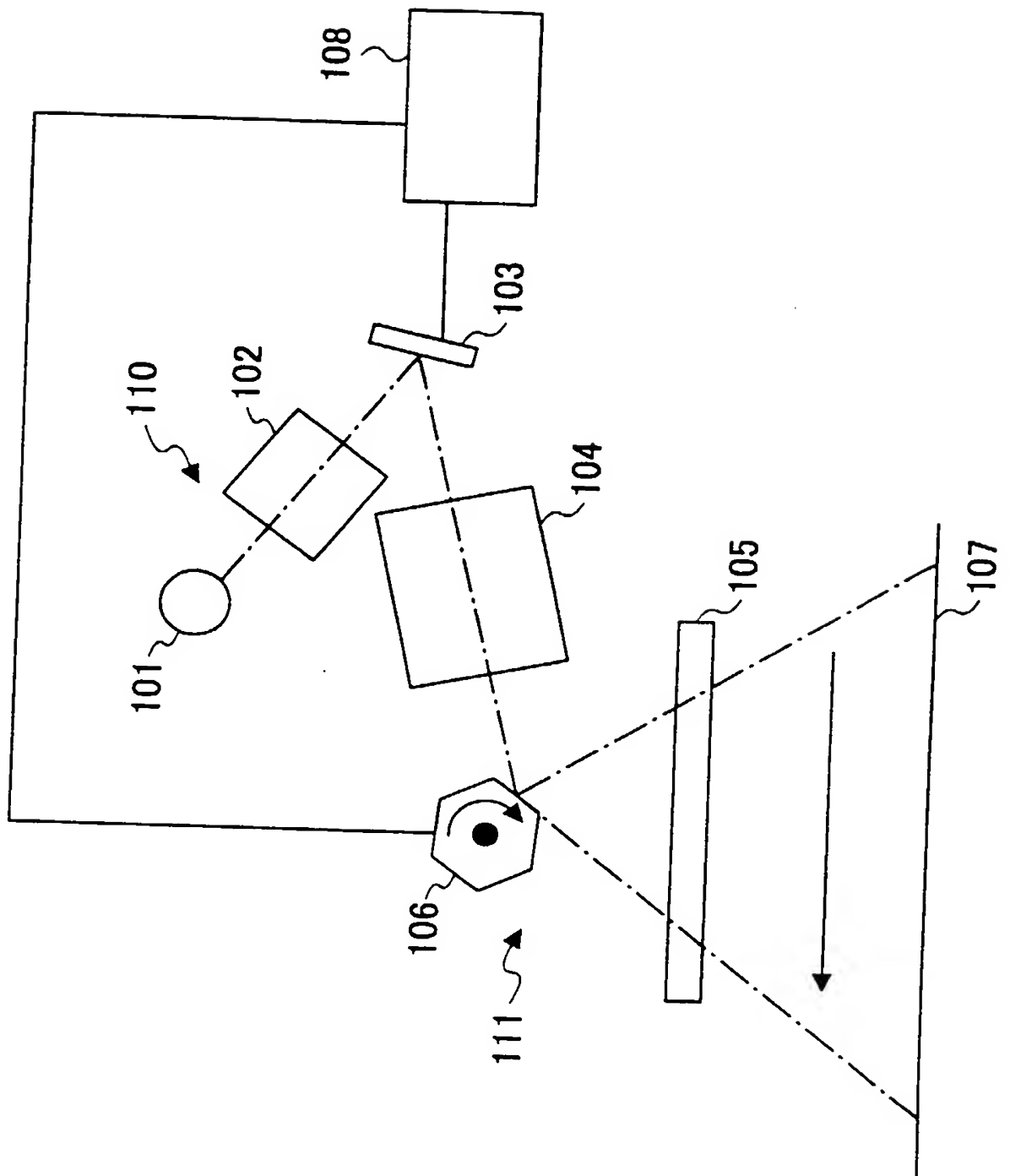
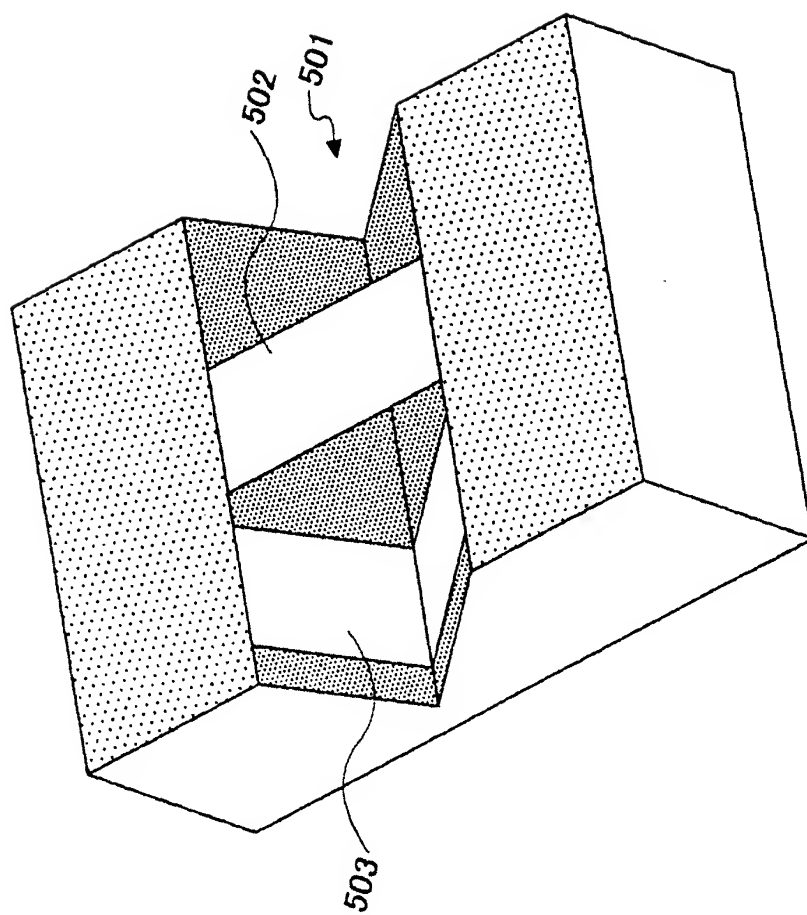


FIG.2



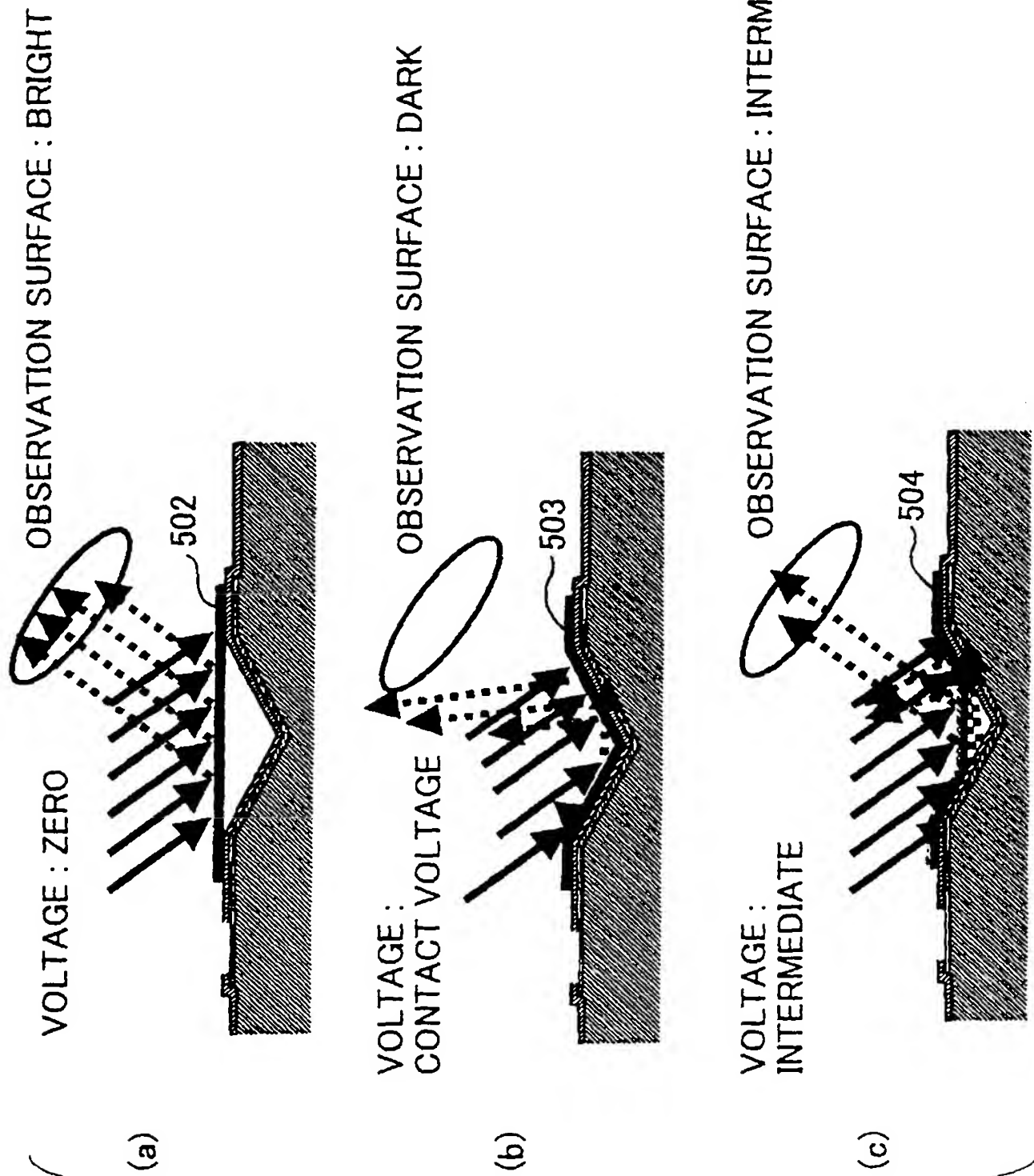


FIG.4

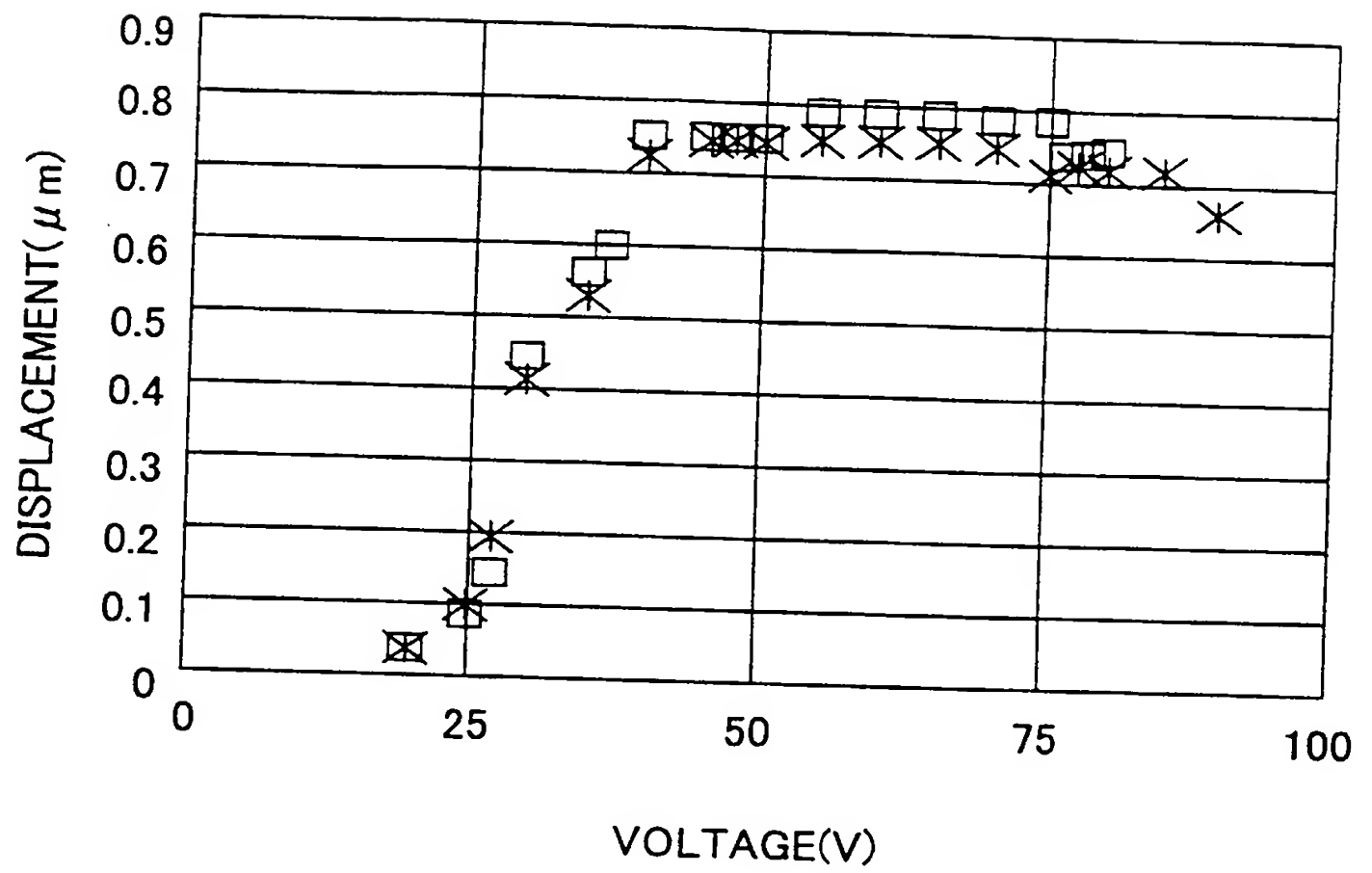


FIG.5

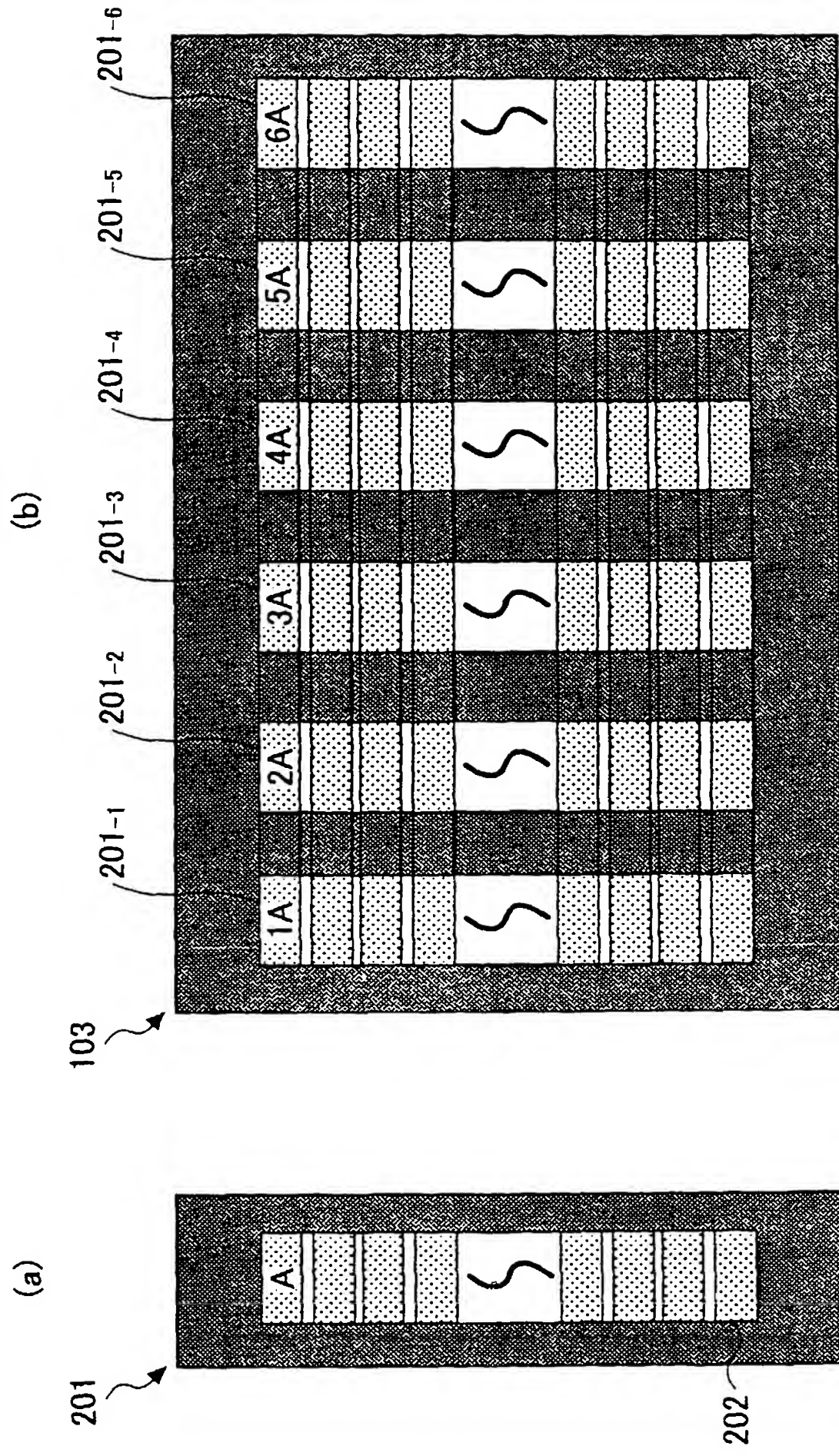


FIG.6

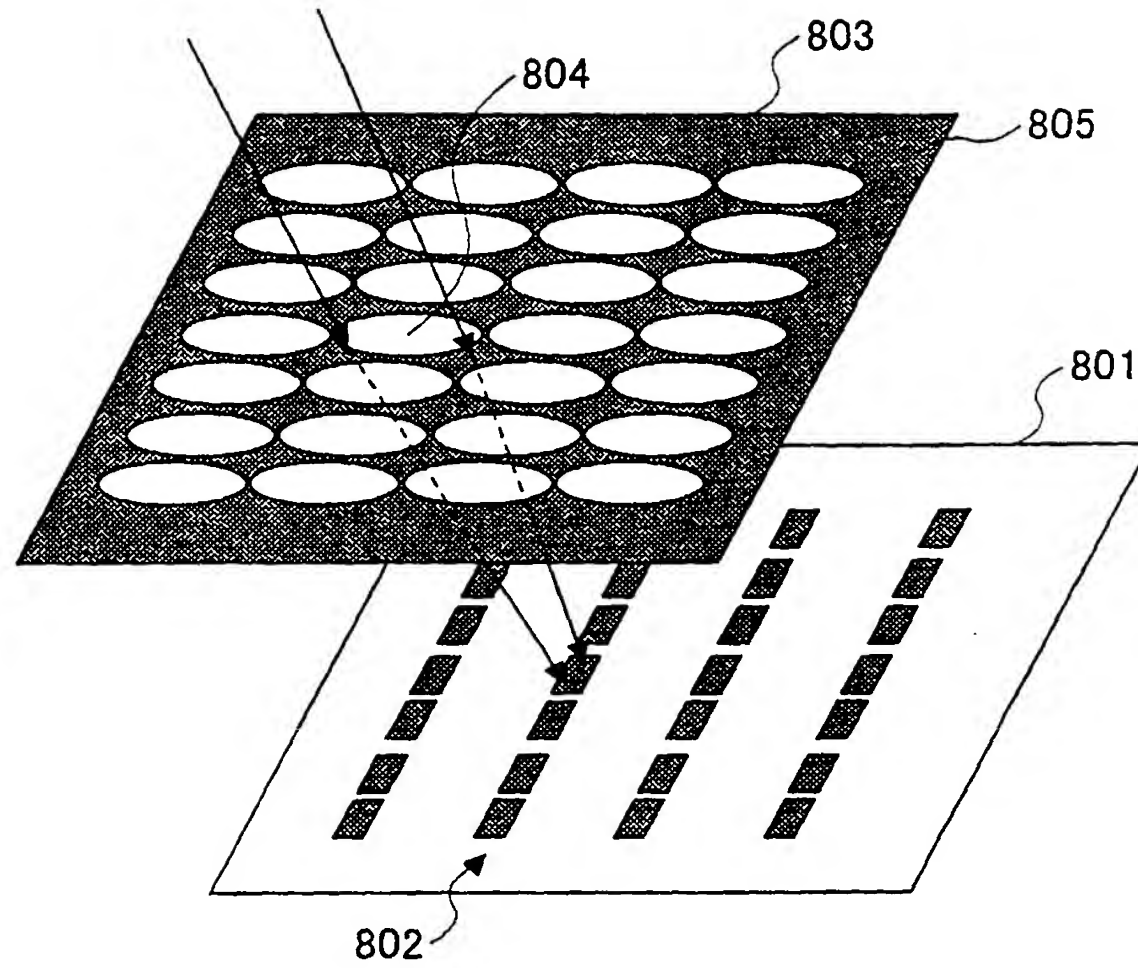
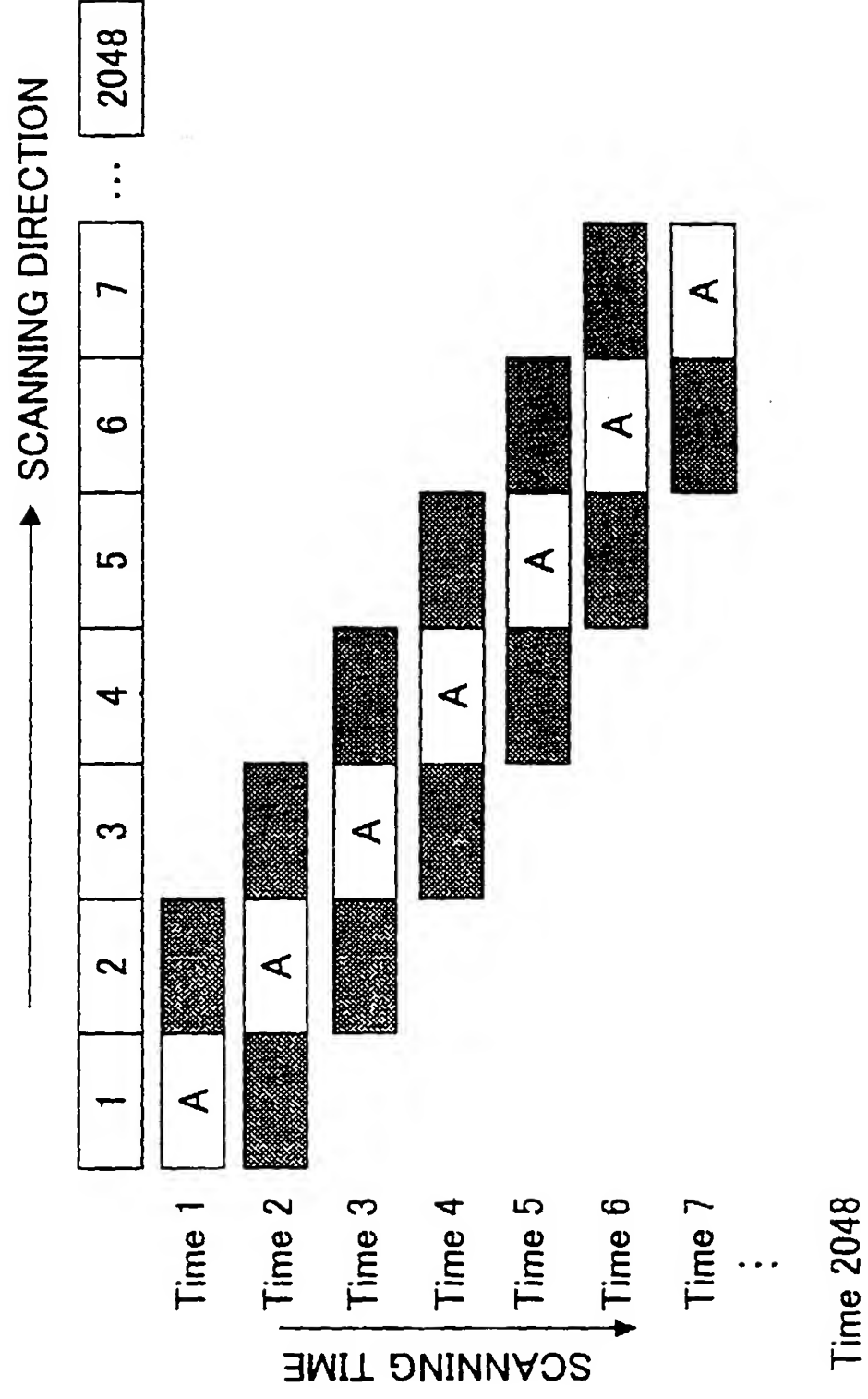


FIG.7



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